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The Topeka Tiller

National Weather Service Topeka, KS

Spring 2022 Volume 15, Issue 1

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Spring Severe Weather Safety

By Chad Omitt, Warning Coordination Meteorologist

The past few years have been relatively quiet when it comes to documented tornadoes across Kansas. Does that mean the risk from tornadoes is decreasing here in Kansas? No, we live in one of the most tornado active states in the country. In fact, Kansas still ranks #1 in tornado frequency per square mile over the past 30 years, so we can't become complacent about the risk. As we move into May and June, it's important to review some basic safety information related to severe weather and the risks that storms can bring here in Kansas.

The most serious risks to you and your family from thunderstorm-related hazards include tornadoes, flash flooding, and lightning. Let's take a quick look at each storm hazard and review the important safety advice for reducing the risk from each.

Tornado Safety

The greatest danger from a tornado is the blowing and falling debris which may be traveling at over 150 mph! So you need to know where to go! ***Remember, get as low as you can and put as many walls between you and the outside as possible.*** Go to your safe room or a basement if you have one, try to get underneath something sturdy, and cover your head with a helmet for extra protection. Back in 2011 when over 500 people lost their lives from violent tornadoes, many fatal injuries were due to blunt force trauma to the head, so use a bike or sports helmet whenever possible! If you don't have a basement, choose a smaller interior room on the lowest floor and cover up as best you can.

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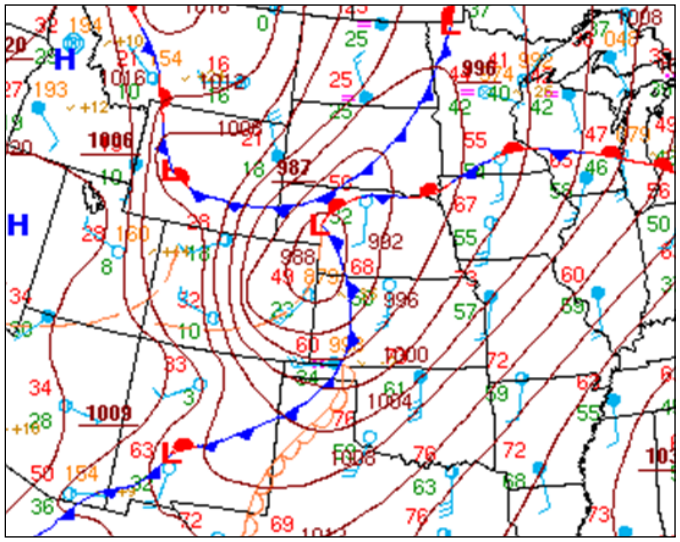
A Wild Day of Weather: December 15, 2021

By Jenni Pittman, Science and Operations Officer

You've heard of Christmas in July – last year, it was like July at Christmastime! An abnormally warm and snowless first half of December 2021 set the stage for an unusual severe weather event on December 15th. On that Wednesday, record high temperatures, extremely strong winds, severe thunderstorms, and fires all plagued the area due to a very strong low pressure system trekking quickly across the Plains.

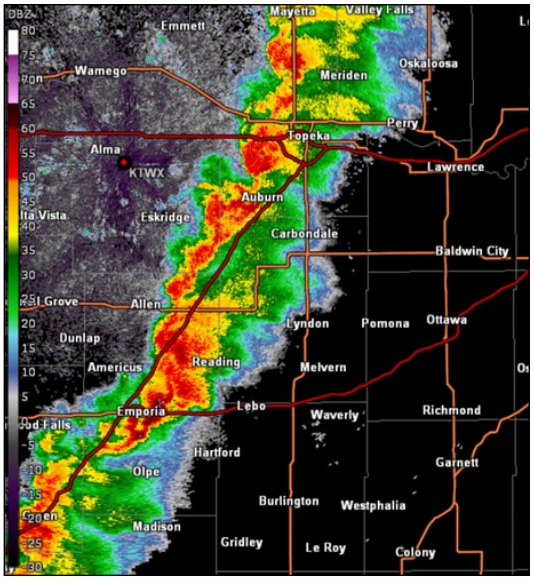


Surface analysis at 12 PM CST on December 15, 2021.

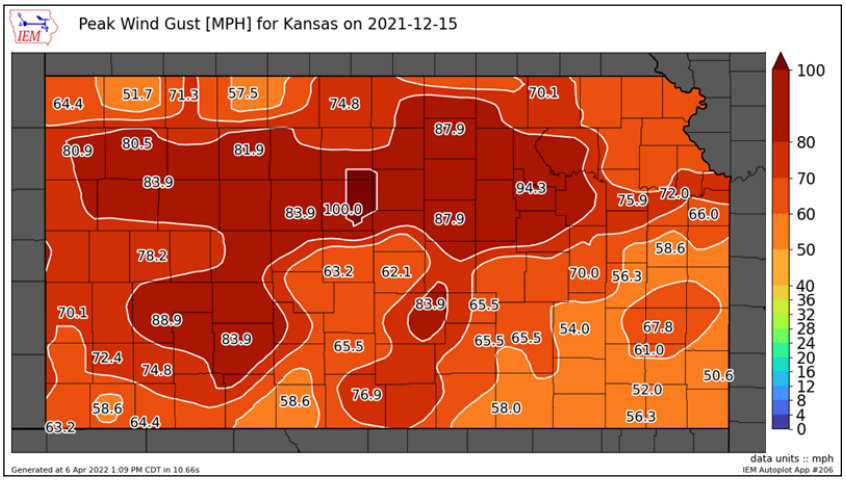
During the morning, winds quickly increased out of the south, reaching sustained speeds of 35 to 45 mph with gusts as high as 55 mph by noon. By early afternoon, southerly wind gusts had reached 55 to 65 mph, and thunderstorms were beginning to develop in northwest Kansas. Temperatures that morning started off in the 60s and climbed to record high values (76° in both Topeka and Concordia). For reference, an average mid-December day should start in the lower to mid 20s and top out in the lower to mid 40s.

Thunderstorms that developed in northwest Kansas began making their way east during the early and mid-afternoon, reaching the Topeka forecast area just after 2 PM CST. Several grass fires also developed in the early afternoon across eastern Kansas and spread quickly in the high winds, but were fortunately controlled prior to the arrival of severe storms. In total, 21 severe thunderstorm and tornado warnings were issued, and 68 reports of severe (≥ 58 mph) wind gusts, thunderstorm wind damage, and hail were received just in the Topeka forecast area.

After storms exited the area, very strong westerly winds (gusting as high as 80 mph) efficiently transported smoke from the large four-county fire in Ellis, Rooks, Osborne, and Russell Counties into the Topeka forecast area. Many in the area reported such a strong smoke smell that the fire responsible was assumed to be very close by, versus in central Kansas. In fact, several dispatch centers as far as 200 miles away from the actual fire went into overload due to the volume of calls reporting the smoke and presumed wildfire. It took several hours and another wind shift to the northwest before the smoke smell abated late Wednesday evening.



Radar as the line of severe storms went through the Topeka area.



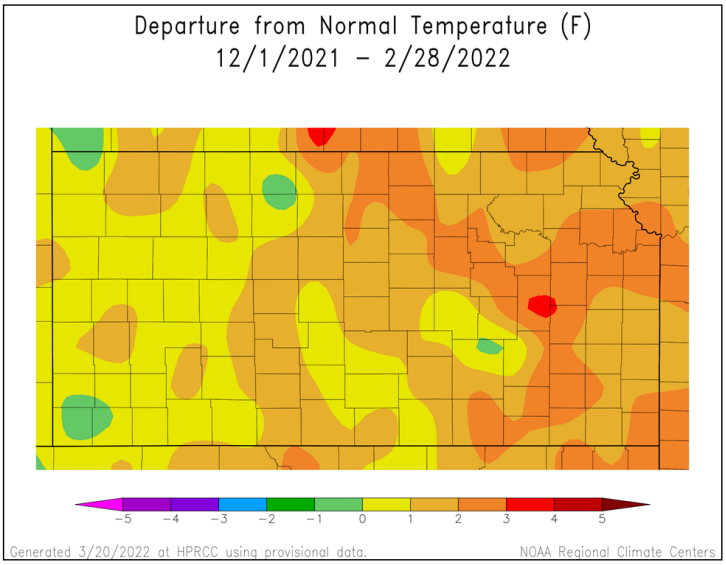
Peak wind gusts in Kansas on December 15, 2021.

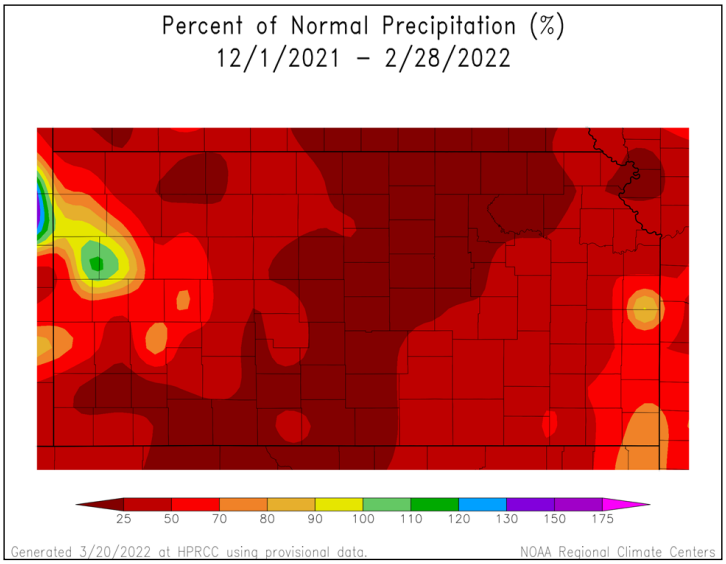
Warm and Dry Winter 2021-2022

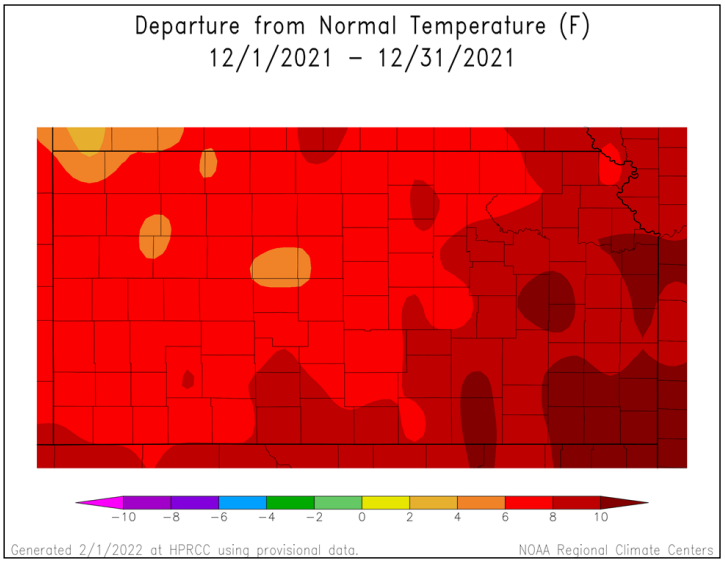
By Kyle Poage, Meteorologist

Although January and February had their share of cold temperatures and wintry precipitation events, a very warm and dry December pushed the winter season of 2021-2022 into the warm and dry categories. Temperatures for the season averaged to be around two degrees above normal across north-central, northeast, and east-central Kansas with precipitation around one-third of normal. In particular, for Topeka, where weather records date back to 1887, the winter was the ninth-driest with a total of 1.43 inches of precipitation, which is 2.40 inches below normal. It was also the twelfth-warmest winter with an average temperature of 35.4 degrees, which is 2.6 degrees above normal. The average low temperature for the season was close to normal, but the average high temperature was 5.5 degrees above normal, placing it as the second-warmest average high temperature on record. Only the winter of 2011-2012 had a warmer average high temperature. The total snowfall for the winter season was 14.8 inches, which is 0.9 inches above normal. For Concordia, where weather records date back to 1885, it was the third-driest winter with only 0.49 inches of precipitation falling, which is 2.10 inches below normal. The average temperature tied for the sixteenth-warmest winter season on record, 3.0 degrees above the normal of 34.0 degrees. As was the case for Topeka, the average high temperature was what made the winter warm. The average high temperature tied for the highest average on record at 47.1 degrees, 6.0 degrees above normal, tying with the 1991-1992 season.

Again for Topeka, December 2021 was the second-warmest and eighth-driest December on record. The high temperature on December 15th was 76 degrees and the high temperature on December 24th was 74 degrees. These readings were the second- and third-highest temperatures on record for any December, respectively. The first measurable snow of the season came January 1st. This was the eighth-latest first snowfall of the winter season on record.







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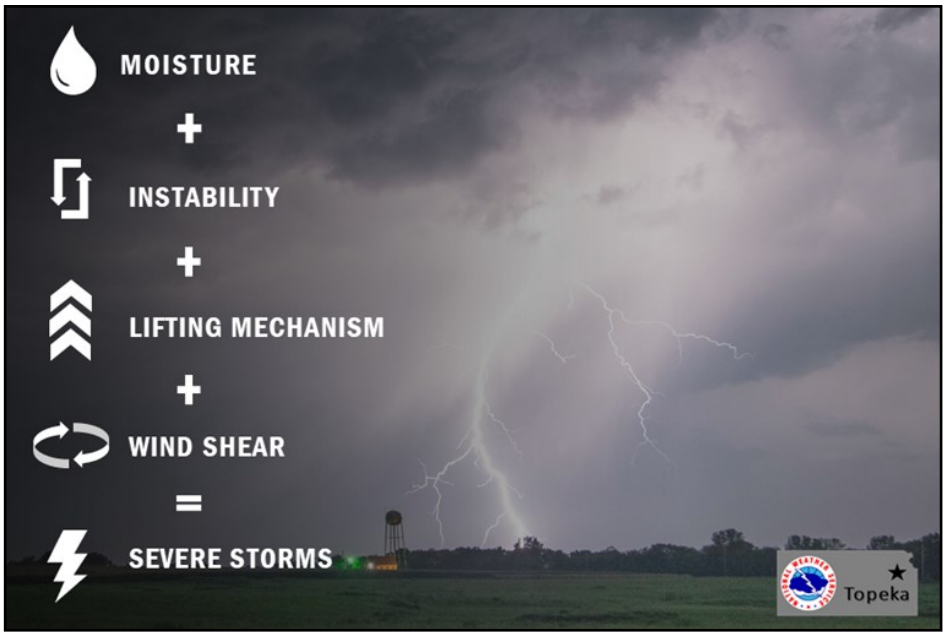
Milk, Eggs, Storms? A Dive into Ingredients Needed for Thunderstorms

By Bryan Baerg, Meteorologist

Milk, vanilla, sugar, eggs, butter, salt, flour, chocolate chips -- all of these ingredients are necessary to make the most delicious batch of chocolate chip cookies. As silly as it may seem, this cookie analogy translates nicely to the elements needed for thunderstorm development. The first ingredient required for thunderstorm development is instability. Instability itself is made up of a few elements including heat and moisture. Typically both of these are transported northward from the Gulf of Mexico. With low-level heat and moisture in place, we then need cold temperatures above the ground level. Warm air is less dense than colder air; therefore rising motion occurs in these scenarios. Even with the rising motion, another lifting mechanism is required to aid the warm and moist air upwards. This typically occurs in the vicinity of frontal boundaries (cold front, warm front, or dryline for example) or well above the ground level with waves of energy. Incorporating this additional lifting mechanism, we have a rising column of air that will likely develop into a thunderstorm. Typically for thunderstorms to become severe, they acquire rotation in response to the ingredient known as wind shear. Wind shear is defined as the changing of wind direction and speed with height. Translating back to baking for a moment, leaving out the butter in the cookie dough will result in a different taste to the cookie. This is true in the potential for thunderstorm development as well – if we do not have a lifting mechanism, thunderstorms will not develop at all. Similarly with instability and moisture, a lack of those and thunderstorms won't occur. The amount of wind shear will impact how intense storms can be, assuming they actually develop.

Here we've quickly assessed the ingredients for thunderstorm and severe thunderstorm development, but not necessarily how the quantity of each ingredient affects thunderstorm formation or not. Very minor changes in any of the ingredients can yield dramatically different outcomes. This is certainly one of the big challenges with forecasting in the warm seasons. Model data may suggest a favorable environment for severe storms, but a minor variation in a single variable may yield dry conditions instead. Hopefully this brief overview provides some insight into the formation of thunderstorms across the Plains!



Application of Satellite Imagery in Assessing Thunderstorm Development and Strength

By Sarah Teefey, Meteorologist

Imagery from NOAA's geostationary satellites GOES-16 and GOES-17 are used by NWS meteorologists for a variety of atmospheric analysis and forecasting purposes. This article will specifically focus on how meteorologists use satellite imagery to monitor for convective development, and then to analyze thunderstorm strength. Several different types of imagery are useful for these purposes.

On a clear day prior to thunderstorm initiation, visible satellite imagery is useful for the detection of cumulus field development (Image 1). When conditions for thunderstorms are right, cumulus clouds will continue to grow in the vertical dimension and can become tall enough to produce rain, lightning, and other thunderstorm hazards. One limitation of visible imagery is that it can only be utilized during daytime hours since it detects clouds by their reflection of sunlight.

The day cloud phase distinction RGB imagery is also useful during the development phase of thunderstorms. Color schemes in this imagery indicate temperature of cloud tops and are useful for differentiating between the water and ice phase of clouds. As cumulus clouds grow vertically, glaciation begins to occur, which can be detected on this particular imagery (Image 2). Glaciation of cumulus clouds is evidence of continued vertical ascent during the thunderstorm development stage and can indicate that lightning might develop soon, making it a valuable forecast tool before echoes become evident on radar.

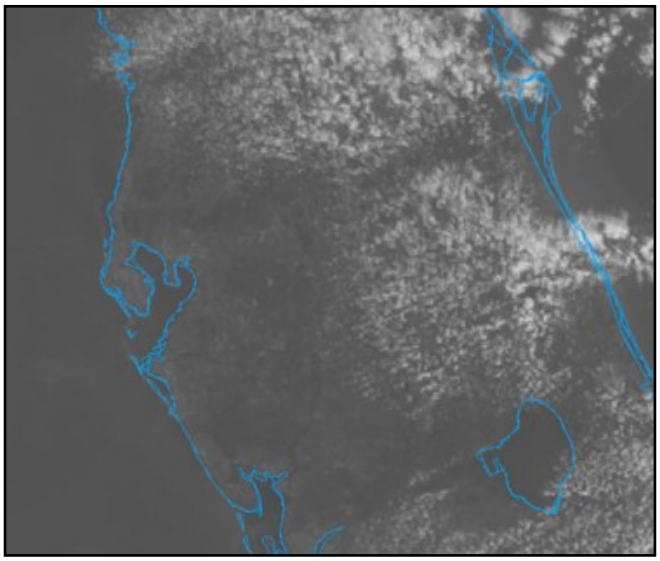


Image 1. Cumulus clouds in visible satellite imagery

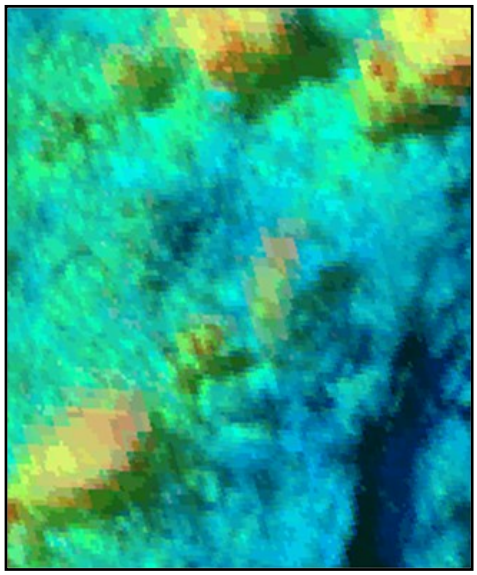


Image 2. Glaciation (greens & yellows) on the day cloud phase RGB

Infrared satellite imagery provides important information after storms have developed. Infrared measures heat radiation and can be used during the day or night. As storms grow and intensify, cloud tops will cool (Image 3). Conversely, as storms weaken, cloud tops warm. This information can aid in the decision process of issuing a severe thunderstorm warning or continuing one.

Various other types of imagery, such as water vapor, help with many other forecasting and nowcasting purposes. However, the kinds of imagery described in this article are popular go-tos during thunderstorm development and maintenance phases.

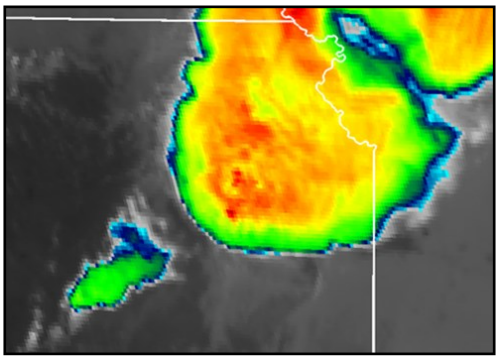
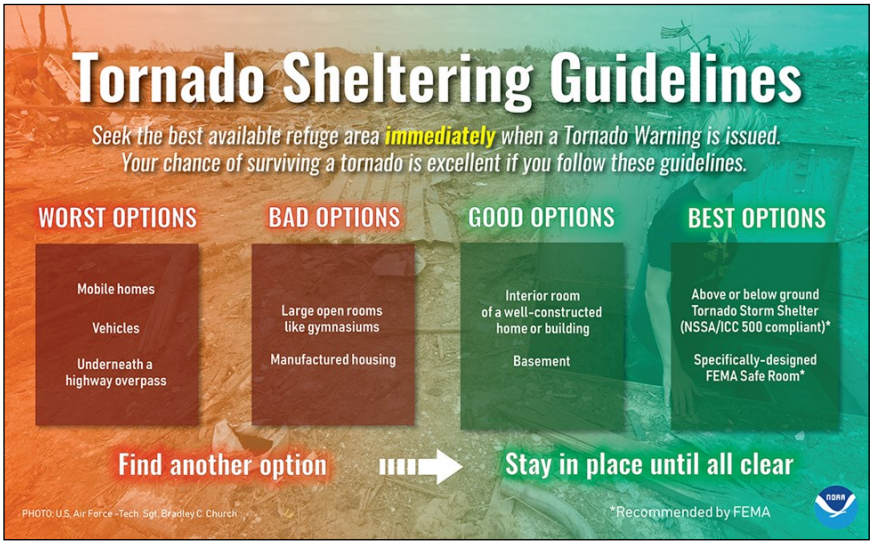


Image 3. Longwave infrared imagery showing cooling cloud tops in ongoing storms

Spring Severe Weather Safety (Continued…)



The worst places to be during a tornado are in a mobile home or vehicle. If you are in a mobile home, go to your designated shelter – either a community shelter or another pre-determined location, like a friend or neighbor's home that has better sheltering options such as a basement or interior room on the lowest floor of a wood-framed home. Do not stay in your mobile home if you are in the path of a tornado!

If you are caught outdoors, you should seek shelter in a basement, shelter, or sturdy building. If you cannot quickly walk to a shelter:

• Immediately get into a vehicle, buckle your seat belt, and try to drive to the closest sturdy shelter.

• If flying debris occurs while you are driving, pull over and park. Now you have the following options as a last resort:

o Stay in the car with the seat belt on. Put your head down below the windows, covering with your hands and a blanket if possible.

o If you can safely get noticeably lower than the level of the roadway, exit your car and lie in that area, covering your head with your hands.

- Your choice should be driven by your specific circumstances.

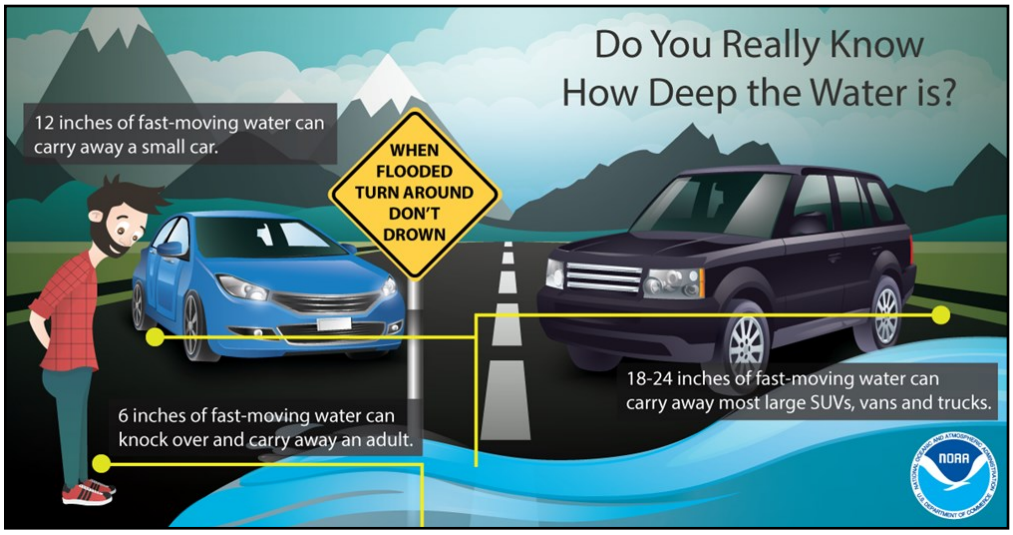
The important thing to understand is that if you find yourself outside or in a car with a tornado approaching and you are unable to get to a safe shelter, you are at risk from a number of things outside your control, such as the strength and path of the tornado and debris from your surroundings. This is the case whether you stay in your car or seek shelter in a depression or ditch, both of which are considered last resort options that provide little protection. The safest place to be is in an underground shelter, basement, or safe room.

Article continues next page...

Spring Severe Weather Safety (Continued…)

Flash Flooding

Don't drive through flooded areas, especially at night in areas you are not familiar with. The majority of deaths due to flash flooding occur with people driving through flooded areas. Believe it or not, water only one foot deep can carry an automobile and you never know the condition of the roadway under the water…it may be gone! If you come upon flood waters, stop! Turn around and go another way. Most flash flood deaths occur in automobiles, so turn around don't drown!



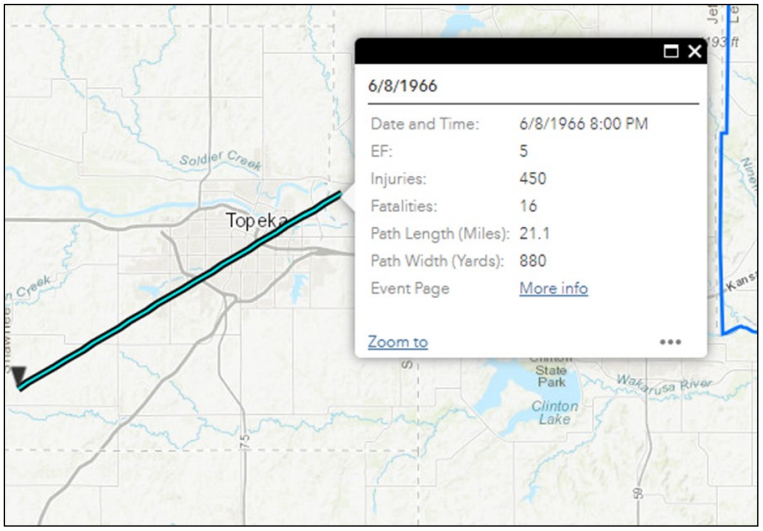
Lightning Safety

The National Weather Service doesn't issue warnings for lightning, so you have to rely on your own sense of hearing to alert you to the presence of lightning around. If you hear thunder, go inside and wait until the thunder has ended and the storm has passed. If you are outdoors at a sports facility and cannot get into an enclosed structure, then go to your car (hard top vehicle), roll up your windows, and keep your hands inside. Wait until the storm has passed before restarting any outdoor activities. You can use a simple method to figure out approximately how close a lighting strike is, which is to count the number of seconds between the flash of lightning and the sound of thunder. Then divide by 5 or 7 to give you an approximate idea of how many miles away the lightning is. Just remember, when thunder roars, go indoors!

New Tornado History Webpage

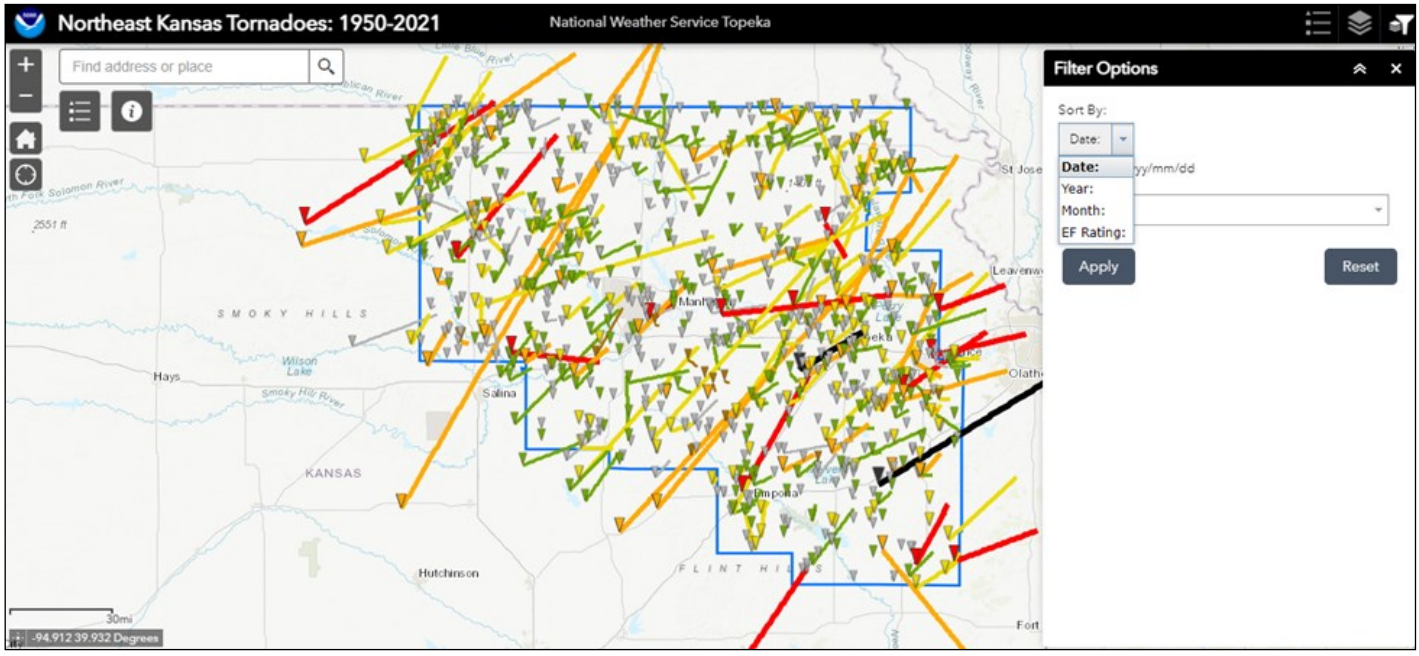
By Daniel Reese, Meteorologist

Have you ever wondered how many tornadoes have impacted a certain area of northeast Kansas? Or have you ever been looking for information about a specific tornado? If so, check out our new tornado history webpage!



This page is an interactive look at all the tornadoes that have occurred in the Topeka warning area since 1950, when official records first started. To narrow down some of the data, users can use the filter button in the upper right. This will give a picture of tornadoes for a specific date, year, month, or EF rating, depending on the user's selection. In addition, clicking on a tornado will open a pop-up window with additional information. Information such as the date/time, length/width, and any injuries or fatalities can be found here. For many significant and/or recent events, there is even a link to a NWS webpage summarizing the event.

The data for these tracks comes from the Storm Prediction Center database (generally for data 1950-2019) as well as local storm surveys and the NCEI Storm Data database (generally for data 2020-present). Any obvious errors (such as reversed start and end points) have been corrected, while any other errors in the official data will be corrected on the map as they are discovered. For now the map includes only the start and end points, so the tornado paths will not display the various left and right turns the tornadoes have made. New tornadoes will be added to the map with time, though typically not until a couple months after the event, once data becomes finalized.



Employee Spotlight! Meet Nathan Griesemer, Our Newest Meteorologist

Hi, my name is Nathan Griesemer, and I am the newest meteorologist here in Topeka! I joined the office as a student intern back in June of 2021 and transitioned into a full-time meteorologist in December of 2021.

My fascination in weather began at a young age as a lot of my science projects revolved around weather topics. I loved experiencing thunderstorms and all the extreme phenomena that came with them! I grew up in Springfield, Missouri and got plenty of opportunities to experience the power of severe weather, but one that made the biggest impact on my childhood fascination was the EF-5 tornado that hit Joplin, MO. I was glued to the television as it was happening and could not believe my eyes with the destruction that followed. It made me want to learn more about all of the different factors that caused extreme weather. Another event that sparked my love for weather was the 2007 ice storm across southwestern Missouri. I remember not having power for over a week after an inch and a half of freezing rain accumulated over my area! I do not know what it was about these extreme weather events that made me so fascinated, but I loved seeing the absolute peak of what the atmosphere is capable of!

I continued my love for weather by taking a meteorology class in high school, and from then on, I knew that was what I wanted to study in college. I pursued my education at the University of Kansas where I majored in atmospheric science! While in Lawrence, I was able to get out and do some storm chasing to see more examples of the raw power of the atmosphere! I recently graduated with my Bachelor of Science degree before getting a job offer here at the Topeka forecasting office!

I am excited to continue my career at the National Weather Service, learn more about operational forecasting from my peers, and support the surrounding community through differing outreach events!

Warm and Dry Winter 2021-2022 (Continued…)

This area's first snowfall of the season was heaviest in northern areas with 4.0 inches measured at Belleville, Concordia, and Holton with around an inch falling south of the Kansas Turnpike. Wind chill values were rather cold January 1st and 2nd with readings of -10 to -20 degrees being common. Another round of cold followed on January 6th with wind chills of -8 to -15 that morning. Another moderate snowfall occurred from late January 14th to late January 15th with around three inches accumulating in northeast and east-central Kansas. A somewhat longer-lived snow fell from the afternoon of February 1st to around sunrise of February 3rd with the heavier amounts falling in east-central Kansas, including five inches at Osage City, 4.6 inches at Topeka, and four inches at Gridley. Wind chills as the storm ended fell to -8 to -13 degrees across the area. A shorter-duration but heavier snow fell from around midnight to the afternoon of February 17th, with again the heaviest snow falling in east-central Kansas, with 9.1 inches measured at Eudora, eight inches at Osage City, and six inches at Garnett. This event began as a wintry mix of precipitation with freezing rain and some thunderstorms. February 23rd saw the final cold snap of the season with wind chills of -8 to -20 that morning.

COOP Corner Spring 2022

By Shawn Byrne, Observing Program Leader

Hi all! Well, another winter has come and gone. Many of the COVID-19 pandemic restrictions have now been rescinded. We are able to visit you all, so please let me know if you have anything that needs to be replaced or repaired in the coming months as we set out on the road for the season. Some of you may get a chance to meet Brandon Drake. Brandon is a meteorologist in our office and will be coming with me on occasion to learn what we do. He can also assist you if you need anything.

The winter was pretty average snow wise for Topeka. We saw 14.8" at the office which was just about an inch above normal. We did have a warm winter with high temperatures the second warmest on record!

Severe weather season is upon us, and most of our snow season is behind us, so now is the time to bring your rain gauge funnels and inner tubes and place them back outside if you haven't already. I am hopeful we will be able to make the usual service runs this summer, so I look forward to seeing you all. We do have one new protocol in place.

I look forward to seeing you all soon!

National Weather Service

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Editor: Chelsea Picha, Meteorologist

Severe Weather Spotting Card :

Weather to Report:

Hail (report any size)

Strong Wind Gusts (58+ MPH)

Any notable wind damage to trees, homes, businesses

Funnel Cloud/Rotating Wall Cloud or Tornado